

61. BOTANY

Part-A (40 Marks):

Evolution of Life and Diversity of Microbes: Origin and evolution of Life with reference to microbes- an outline. **Viruses:** Structure, replication and transmission; plant diseases caused by viruses and their control. Brief account of Archaeobacteria, Chlamydia, Actinomycetes and Mycoplasma. **Bacteria:** Structure, nutrition, reproduction and economic importance. An outline of plant diseases of important crop plants caused by bacteria and their control. **Cyanobacteria:** Cell structure, thallus organization and their prospecting (uses)-Biofertilizers. Structure and life history of *Oscillatoria*, *Nostoc* and *Anabaena*.

Algae and Fungi: Algae: General account, thallus organization, structure, reproduction, classification and economic importance. Structure, reproduction, life history and systematic position of *Oedogonium*, *Coleochaete*, *Chara*, *Ectocarpus* and *Polysiphonia*. **Fungi:** General characters, classification and economic importance, Structure, reproduction and life history of *Albugo*, *Saccharomyces*, *Penicilium*, *Puccinia*, *Alternaria*, General account of plant diseases caused by Fungi and their control. **Lichens:** Structure and reproduction; ecological and economic importance.

Bryophyta and Pteridophyta: Bryophytes: General characters, classification and alternation of generations. Structure, reproduction, life history and systematic position of *Marchantia*, *Anthoceros* and *Polytrichum*. Evolution of Sporophyte in Bryophytes. **Pteridophytes:** General characters, classification, alternation of generations and evolution of sporophyte, Structure, reproduction, life history and systematic position of *Rhynia*, *Lycopodium*, *Equisetum* and *Marsilea*, Evolution of stele, heterospory and seed habit in Pteridophytes.

Gymnosperms and Palaeobotany: Gymnosperms: General characters, structure, reproduction and classification, Morphology of vegetative and reproductive parts, systemic position, life history of *Pinus* and *Gnetum*, Distribution and economic importance; endangered Gymnosperms, **Palaeobotany:** Introduction, Fossils and fossilization; Geological time scale; Importance of fossils, Bennettiales: General account.

Anatomy: Meristems: Types, histological organization of shoot and root apices and theories, **Tissues and Tissue Systems:** Simple, complex, and *special tissues*, **Leaf:** Ontogeny, diversity of internal structure; stomata and epidermal outgrowths, **Stem and root anatomy, Vascular cambium-** Formation and function. Anomalous secondary growth of stem-*Achyranthes*, *Boerhavia*, *Bignonia*, *Dracaena*; *Root - Beta*. **Wood structure:** (General account) Study of local timbers – Teak (*Tectona grandis*), Rosewood, (*Dalbergia latifolia*), Red sanders, (*Pterocarpus santalinus*) Nallamaddi (*Terminalia tomentosa* (*T. alata*), and Neem (*Azadirachta indica*).

Embryology: Introduction to Embryology, Anther structure, Microsporogenesis and development of male gametophyte, Ovule Structure and types; Megasporogenesis; types and development of female gametophyte, Pollination – Types; Pollen – pistil interaction, Fertilization, Endosperm – Development and types, Embryo – development and types; Polyembryony and Apomixis – an outline, **Palynology:** Pollen morphology, NPC system, application of Palynology.

Taxonomy: Introduction: Principles of plant systematics, Systematics vs Taxonomy, Types of classification: Artificial, Natural and Phylogenetic, Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantle. An introduction to Angiosperm Phylogeny Group (APG), Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy, Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy, Nomenclature and Taxonomic resources: An introduction to ICBN, Vienna code – a brief account. Herbarium: Concept, techniques and applications, Systematic study and economic importance of plants belonging to the following families: Annonaceae, Capparaeae, Rutaceae, Fabaceae (Faboideae/Papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae, Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae and Poaceae.

Part-B (60 Marks):

Cell Biology: Plant cell envelopes: Ultra structure of cell wall, molecular organization of cell membranes, **Nucleus:** Ultrastructure, Nucleic acids – Structure and replication of DNA; types and functions of RNA, **Chromosomes:** Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype, Special types of chromosomes: Lampbrush, Polytene and B-chromosomes, **Cell division:** Cell cycle and its regulation; mitosis, meiosis and their significance.

Genetics: Mendelism: Laws of inheritance, Genetic interactions – Epistasis, complementary, supplementary and inhibitory genes, **Linkage and crossing over:** A brief account, construction of genetic maps-2 point and 3 point test cross data, **Mutations:** Chromosomal aberrations – structural and numerical changes; Gene mutations, **Gene Expression:** Organization of gene, transcription, translation, mechanism and regulation of gene expression in prokaryotes (Lac and Trp Operons), **Extra nuclear genome:** Mitochondrial and plastid DNA, plasmids.

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Ecology: Concept and components of Ecosystem. Energy flow, food chains, food webs, ecological pyramids, biogeochemical cycles – Carbon, Nitrogen, Phosphorus, **Plants and environment:** Ecological factors – Climatic (light and temperature), edaphic and biotic. Ecological adaptations of plants, **Population ecology:** Natalty, mortality, growth curves, ecotypes, ecads, **Community ecology:** Frequency, density, cover, life forms, biological spectrum, ecological succession (Hydrosere, Xerosere), **Production ecology:** Concepts of productivity, GPP, NPP, CR (Community Respiration) and secondary production, P/R ratio and ecosystems.

Biodiversity and Conservation: Biodiversity: Concepts, Convention on Biodiversity – Earth Summit. Types of biodiversity, Levels, threats and value of Biodiversity, Hot spots of India – Endemism, North Eastern Himalayas, Western Ghats, **Agro-biodiversity:** Vavilov centres of crop plants, Principles of **conservation:** IUCN threat-categories, RED data book – threatened & endangered plants of India. Role of organizations in the conservation of Biodiversity – IUCN, UNEP, WWF, NBPGR.

Physiology: Water Relations: Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis; water, osmotic and pressure potentials; absorption, transport of water, ascent of sap; transpiration; Stomatal structure and movements. **Mineral Nutrition:** Essential macro and micro mineral nutrients and their role; symptoms of mineral deficiency; absorption of mineral ions; passive and active processes. **Enzymes:** Nomenclature, characteristics, mechanism and regulation of enzyme action, enzyme kinetics, factors regulating enzyme action. **Photosynthesis:** Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect; concept of two photo systems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation; Carbon assimilation pathways: C₃, C₄ and CAM; photorespiration. **Translocation of organic substances:** Mechanism of phloem transport; source-sink relationships.

Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, pentose phosphate pathway, **Nitrogen Metabolism:** Biological nitrogen fixation, nitrate reduction, ammonia assimilation, amino acid synthesis and protein synthesis, **Growth and Development:** Definition, phases and kinetics of growth. Physiological effects of phytohormones- auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids. Physiology of flowering and photoperiodism, role of phytochrome in flowering.

Tissue Culture and Biotechnology: Tissue culture: Introduction, sterilization procedures, culture media – composition and preparation; explants. Callus culture; cell and protoplast culture, Somatic hybrids and cybrids. Applications of tissue culture: Production of Pathogen free plants and somaclonal variants, production of stress resistance plants, secondary metabolites and synthetic seeds. **Biotechnology:** Introduction, history and scope, **rDNA technology:** Vectors and gene cloning and transgenic plants.

Seed Technology and Horticulture: Seed: Structure and types, Seed dormancy; causes and methods of breaking dormancy, Seed storage: Seed banks, factors affecting seed viability, genetic erosion. Seed production technology; seed testing and certification, **Horticulture techniques:** Introduction, Cultivation of ornamental and vegetable crops, Bonsai and landscaping, **Floriculture:** Introduction. Importance of green house, polyhouse, mist chamber, shade nets; Micro Irrigation systems. Floriculture potential and its trade in India, Vegetative Propagation of Plants: Stem, root and leaf cuttings. Layering and bud grafting. Role of plant growth regulators in horticulture.

Medicinal Botany: Ethnomedicine: Scope, interdisciplinary nature, distinction of Ethnomedicine from Folklore medicine. Outline of Ayurveda, Sidda, Unani and Homeopathic systems of traditional medicine, Role of AYUSH, NMPB, CIMAP and CDRI. **Plants in primary health care:** Common medicinal plants – Tippateega (*Tinospora cordifolia*), tulasi (*Ocimum sanctum*), pippallu (*Piper longum*), Karaka (*Terminalia chebula*), Kalabanda (*Aloe vera*), Turmeric (*Curcuma longa*), **Traditional medicine vs Modern medicine:** Study of select plant examples used in traditional medicine as resource (active principles, structure, usage and pharmacological action) of modern medicine: Aswagandha (*Withania somnifera*), Sarpagandha (*Rauwolfia serpentina*), Nela usiri (*Phyllanthus amarus*), Amla (*Phyllanthus emblica*) and Brahmi (*Bacopa monnieri*), **Pharmacognosy:** Introduction and scope. Adulteration of plant crude drugs and methods of identification – some examples. Indian Pharmacopoeia, **Plant crude drugs:** Types, methods of collection, processing and storage practices. Evaluation of crude drugs.